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RESISTANCE OF BOTTLES TO ABUSE

A paper prepared at the suggestion of members of the Testing Procedure Committee of the Glass Container Association, V. L. Hall, Secretary*

By F. W. PRESTON

Experience shows that there is comparatively little difficulty in making bottles and other containers strong enough for "normal" use. It also shows that abuse is the rule, and that rough handling and throwing around, battering and bumping, is the destiny of bottles. Until recently this was accepted subconsciously, and no one thought a great deal about it. The bottle was made, used, and broken, and when it broke, it caused no comment. It was taken for granted that bottles were brittle and that they would break. They were never thought of as being strong, and, generally speaking, no one had any idea how strong they were.

As systematic investigation developed, however, it became clear that bottles, for the most part, were so strong in proportion to the service that was required of them, that there was no more reason to expect them to fail than there was to expect a well designed bridge to fall down. When a bottle broke, something abnormal had occurred. The abnormal turns out to be, in nearly every case, not some defect in manufacture, but failure to treat it properly thereafter.

Some of the procedures that constitute abuse are not obvious. Seemingly harmless procedures can be very harmful. The damage is sometimes inconspicuous and subtle, but it can be extraordinarily damaging. Some of these matters have been the subject of previous memoranda: in the present discussion, we are concerned only with those factors in *design* and in *manufacturing* that affect resistance to abuse, not those elements that enter in subsequently to, and independently of, manufacture.

Definitions

"Normal use" of a bottle involves (a) merely being in existence over a substantial length of time: factory rejected disannealed or excessively cordy bottles may break spontaneously with the mere passage of time; (b) normal use involves the ability to withstand changes of temperature over a substantial range, even if these changes are rapid; (c) normal use in the case of pressure ware involves the ability to carry indefinitely the pressures due to carbonated liquids and the like, bottled in their interiors; (d) normal use involves the ability to withstand the screwing on, or unscrewing, of lids, the ability to withstand the pressures and forces of capping machines, and so forth.

Usages (a) to (c) are provided for in the G.C.A. Standard Testing Procedure.[1] Item (d) is taken care of in ordinary design, and by checking the geometrical accuracy of manufacture.

Abuse means chiefly battering and bruising by impacts. Thus in the south, Cola bottles are bought at a counter. the contents drunk offhand, and the empty bottle thrown in a barrel across the store, or upon a pile of bottles outside the door. The bigger the noise of the impact, the better the customer is pleased. Further north, the beer addict takes a couple of beer bottles in each hand, holding them by the necks. At each step, he clicks one bottle against another, much as a negro plays the "bones," and the music is sweet in his ears, until the bottle breaks.

Abuse is not often thermal shock abuse, nor is it often unintelligent submission to excessive "weathering" or chemical corrosion, though both of these can happen.

Expectation of Abuse with Different Sorts of Bottles

In general small bottles are more abused than large ones. Five gallon carboys are not thrown around so freely as half pint bottles; and half gallon, or even quart, bottles are less often carried around, two at a time, by the neck, to hear them clink.

Champagne bottles are not usually treated with as much contumely as beer bottles; and ginger ale bottles are not thrown about so much as colas and other "soft drinks." Single trip bottles of all sorts have less opportunity to become weakened from abuse than multiple trip bottles, which are commonly used, however chipped, bruised, and disreputable looking they become, so long as they can stand up at all in one piece.

Methods of Testing for Resistance to Abuse

A number of impact tests have been devised and used here and there. Most of them use a pendulum hammer-blow, and seem to be patterned after the Charpy and Izod impact tests for metals, though the conditions are in no

*The members of the Committee do not necessarily endorse all statements in this paper, and it is released for publication without formal approval of the Committee.

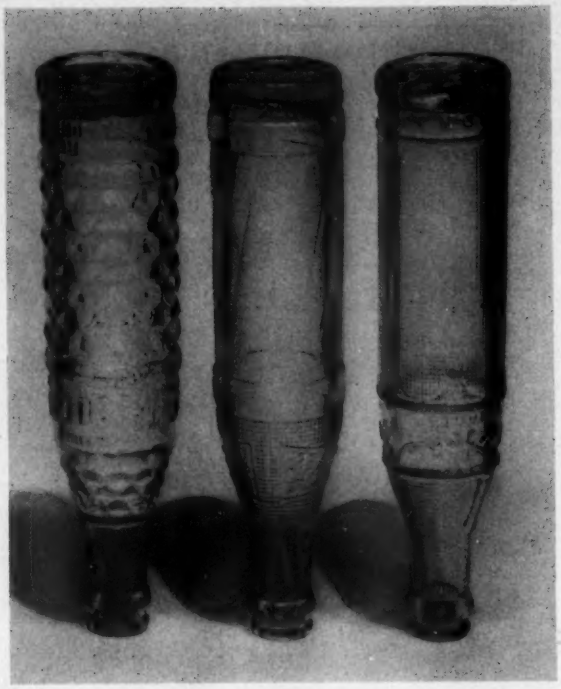


Fig. 1. Three "soda " bottles of conventional (old style) shape. The two outer ones have become badly chipped at the base because of lack of "spring" in the Murgatroyd Belt area.

Fig. 2. View of the base of bottle on left in Fig. 1, showing more clearly the damage resulting from excessive rigidity at this point.

Fig. 3. View of base of bottle on right in Fig. 1.

way comparable. Apparently a few experimenters and a few plants believe that the tests have some utility, but there has been no general acceptance of them. In the flat glass industry, for a generation past, there has been a modest amount of testing by means of a falling hardened steel ball. As a single impact, this has been used in the plate glass and wire glass industries. It became much more general comparatively recently, in the development of "Armourplate," "Securit," and so forth; and very heavy steel balls falling from great heights were used. Government specifications for impact testing of hardened goggles use the same method. E. L. Hettinger extended the tests to repeated impacts, at the same place on the glass, using thousands of repeats. Owens-Illinois adopted the single-drop test for some of their bottles, and extended it to several impacts at different places. In the Preston Laboratory machine, there is used a succession of impacts by falling 1 in. steel balls, dropping on a bottle which is rotated and traversed at the same time, the points of impact forming a spiral on the bottle.

Impacts can be of so varied a character in practice, that it is difficult to devise any strictly simulative tests. The impacting ball seems to have much to recommend it, as an arbitrary simplification.

Apart from external impacts, which are the main cause of bottle damage and failure, there is the trouble from internal impacts. These are (a) internal scratching, which is a dynamic action involving chattering, and (b) water hammer breakage, due to the impact of liquids, usually water. Since this latter has recently been treated at length by T. C. Baker,[2] we do not discuss it here.

Heel Design as a Factor in Resistance to Abuse

If a blacksmith wants to "abuse" a piece of iron, to forge it to shape, he needs an anvil as well as a hammer. Hitting the iron in mid air will do him no good. He wants a solid mass to "back up" his blow. The application of this elementary principle to bottle design was not made till recently. It was then found that a comparatively thin-walled bottle lying on its side would bounce the impacting ball very efficiently, but that at the end of the bottle, where the sidewall was supported solidly by the base, the impact was inelastic, and it was easy to knock off a spall.

The remedy was obvious. The junction of base and sidewall must be "drawn-in" or "undercut," so that it is not easy to impact this point. If this process is carried far enough, the base of the bottle tends to become more or less a first approximation to a hemisphere, and there is no true junction of base and sidewall. Such bottles are strong against impact, but unsteady on their bases, and not easy to run through filling machines, so a compromise is necessary. Fortunately, the compromise makes an immense difference.

The fact that thin walls are springy, makes the bottles much more efficient than might be expected of them. The strength of bottles does not by any means increase in direct proportion to their weight, so far as impact is concerned.

In Fig. 1 we have a photograph of 3 soda bottles of conventional type. They are long and narrow, extravagantly decorated with blown-in-the-glass designs. The walls are massive, the bottles very strong. Yet two of

them are poor designs. On account of their extravagant elongation, they are unsteady on their bases, and if sent down a filling line at modern speeds, they are apt to fall over. To give them a maximum of steadiness, the bases are made as large as possible, in two examples, so that battering takes place just where it shouldn't. Heavy spalls have been knocked off the base in these two, in actual service, and the examples shown will no longer stand up. (Figs. 2 and 3.)

The third bottle is different: a battering-belt has been provided a little higher up, and this bottle is still in working order. It is, however, probably a little less steady than the others, when all are new.

It seems clear, however, that as filling speeds increase, a more rational shape of bottle will have to be used. Apart from this practical aspect of the operation of filling lines, it seems also established that these bottles are weak in proportion to the amount of glass in them. That is not to say they are weak bottles, but only that for the same weight and capacity, they could be a lot stronger against use as well as against abuse. Or otherwise expressed, more serviceable bottles could be made with less glass in them, if the bizarre proportions were discarded.

In Fig. 4, we have three ginger ale bottles, standing upside down on their "finishes," so that we can get a good look at their bases.

The one at the left is the old style bottle with a perfectly cylindrical sidewall coming down till it meets the base-plate mold seam. This bottle is poor against chipping of the base, and it is possible that its vulnerability is increased by the raised lettering.

On the right we have an improved version. Here the sidewalls are drawn-in slightly, so that the base-plate seam is in a less vulnerable spot. But the lettering remains, and the upper part of the letters is in the zone normally subject to percussion, and not very much above the "anvil-line."

In the center we have a model from which the lettering has been removed. It will probably be conceded that it is distinctly more pleasing aesthetically and it is possible that it is less vulnerable mechanically. But the vulnerability of typical raised lettering is distinctly different from that of some other ridges, such as ream marks and some forms of stippling. The latter concentrate the stress on impact, but do not seem to localize the cracks, while some forms at least, of raised lettering, while they concentrate the impact stresses, seem to localize the damage. This apparently comes about by a pulverizing of the lettering, which is unsightly, but in some cases actually lessens the vulnerability of the bottle as a whole. This subject is therefore complex.*

A further improvement could now be made by changing the proportions of the bottle, somewhat decreasing the height and increasing the diameter. Such a bottle would have greater stability, having, like a modern automobile, a low center of gravity, being less likely to upset at high speeds on the filling line; it would be stronger for a given weight of glass, or alternatively could be made with a little less glass for equal strength;[3] [4] and without decreasing the basal area, could have a little more "pull-in" of the lower sidewalls, which is both aesthetically and mechanically more satisfactory.

*Some interesting results on this point have recently been sent us by Mr. K. C. Lyon of Armstrong Cork Co.

Stippling and Molded Lettering as a Factor in Resistance to Abuse

Plain bottles with uniformly smooth, highly glazed, surfaces are much more resistant to impact on the heel (with steel balls at any rate) than bottles decorated, for instance, by sharp angle "stippling." The little ridges of the stippling result in high local stresses under impact, and therefore "sharp" stippling should be avoided as far as possible, especially in the critical zones.

Equally important is raised lettering, blown in the glass. This is one way of identifying the maker of the bottle, or the bottler of the beverage, or of indicating the volume of the contents or the date of manufacture. Raised lettering, particularly near the heel, that takes the form of pronounced little ridges should probably be avoided.

Mold Partings

The mold, or molds, that determines the outside contour of a bottle is made up of at least 7 pieces. The blank mold is split vertically into two: the ring mold is likewise, and so is the blow mold, while the base plate makes up the heavenly number. These molds, or pieces of mold, are machined carefully to a good fit; but there has to be some clearance, and they run hot and the clearance usually increases. Wherever the several parts adjoin, we may expect, and sometimes get, a little ridge of

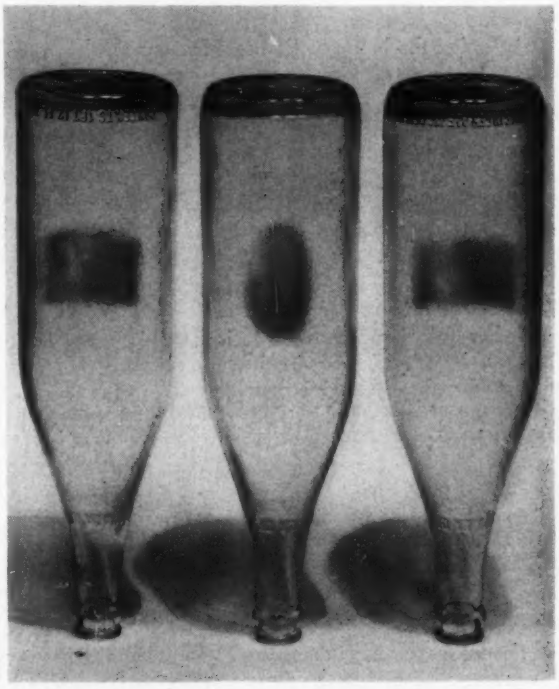


Fig. 4. Left: A ginger ale bottle, old style, with a substantially "square" junction of base and sidewall, and lettering just where it is best avoided.

Right: The base "drawn-in," or "undercut," but the lettering still somewhat vulnerable.

Center: The design "cleaned up."

glass protruding slightly. These "seams" or parting-marks have much the same influence as stippling or raised lettering, so far as impact is concerned. They act as stress-concentrating devices under impact.

The blank mold seams are the least important as a rule (though they are sometimes the most important in thermal shock resistance), because they are partly obliterated or even folded-in, in the blow operation. The blow mold seams and the base plate join, are most important in impact, particularly at the Murgatroyd belt, the inelastic junction of base and sidewall (lower ¾ in. of the sidewall).

In handmade ware it is commonly possible to obliterate the mold marks to some extent, by rotating the ware inside the mold during the blowing operation. In the Corning Bulb Machine the mold is rotated around the ware with the same result. A machine for blowing bottles is theoretically conceivable that would produce some approximation to this, but it should be noted (a) that such a machine can produce only circular bottles, which would exclude all panelled, square, and flask shaped ware, (b) that it would exclude all decorated ware (except A.C.L.), (c) that it would exclude all possibility of lettering or dating or trade-marking "blown in the glass," (d) that some means must be provided for holding the neck or finish against rotation while the body-mold rotates. In general, there seems little point at present in attempting to produce such a machine.

Better solutions appear probable along such lines as these:

(a) Keep the seam marks as inconspicuous as possible by careful attention to mold upkeep.

(b) Design the bottle so that mold seams on the Murgatroyd belt are, as far as possible, inaccessible to impact.

(c) Use post-bottoms instead of cup-bottoms, a solution apparently first proved valuable for Coca-Cola bottles.

(d) Refire the basal part of the bottle after molding and before annealing, much as the "finish" is fired in order to remove mold-seams.

General Avoidance of All Small Ridges

Whether the ridges are decorations in the nature of stippling, lettering blown in the ware, or unavoidable mold marks, they should be avoided as much as practicable, and if unavoidable, then placed where they do the least harm.

Fig. 5a

Fig. 5b

It should be clearly understood that these ridges do not concentrate stress in the same way as notches do. It is not a "notch effect." The ridges are harmless, except under impact. Then their effect is to cause the impact to be more sharply localized (Figures 5a and 5b) so that while 5a may be an elastic collision, 5b starts a crack.

Thus in some Cola bottles tested under repeated impact with 1 in. steel balls dropped 24 in., using 11 impacts distributed over the zone under test, we found that among strictly "plain" bottles, with freedom from raised lettering and stippling, the bottles that sustained one or more definite chips numbered only 3 to 8 per cent, while bottles otherwise similar, but stippled, chipped to the extent of anything from 43 to 100 per cent.

General Factors in Design. Circularity

For a given weight of glass, a substantially spherical shape is the strongest container. It is a simple shape to make, and, in bottles of moderate or light weight, it tends to give the most uniform distribution of glass. A circular cylinder is only half as strong as a sphere, but it is, in its turn, vastly stronger than a square or rectangular bottle. These matters have been previously discussed,[5] but refer to use, normal use, of bottles, rather than abuse. In general, non-circular bottles belong in the non-refillable, one-trip category, and the problem of abuse is much less. Except on certain filling lines, bottles are not usually badly abused until they have been emptied once. It is in the handling of "empties" and "returns" that the worst abuse usually occurs.

Fig. 6

No really adequate studies of the resistance of non-circular bottles to abuse seem to have been made.

The use of spherical or sub-spherical containers might be worth more investigation than it has received. Most modern lamp bulbs may be classified as essentially spherical, and they stand a lot of abuse.[6] Club sodas (Fig. 6) may be regarded as sub-spherical, and are very strong. Glass distribution is good, vulnerable points are well protected, and they stand abuse well. At the same time they are awkward in two respects. They are not very stable on their bases and are not the easiest of things to work down a filling-line; and they do not pack well—that is, they take up a lot of space in proportion to the volume of contents.

The modern one-trip beer bottle is perhaps the best compromise yet reached between stability on a filling line and strength against both use and abuse. It can hardly be called sub-spherical, but is on its way to such a shape.

Relation of Absolute Size to Abuse Resistance

We have already commented that large bottles are not so commonly abused as small ones. On the other hand, they are not so robust. The same factors that limit uniform distribution in a single bottle, cause it to be more difficult to get uniform distribution in large bottles than in small. A large bottle is not a small bottle "photographed up." Its outside could be, but its inside couldn't.

The general result is that large bottles are disproportionately weak. It is no use putting a lot of extra glass into the large bottles: it will not stay where it is needed. Thus whether use or abuse is involved, the larger bottles are the weaker vessels.

As against "use," certain quantitative data are available, from which the figures below are quoted:

AVERAGE HYDROSTATIC PRESSURE STRENGTH BOTTLES OF VARIOUS SIZES

	lb./sq. in.			
	Half Pint	*Pint*	*Quart*	*Half Gallon*
Steinies	590	300	220	160
Ginger Ales	460	390	290	—
Stubby Sodas	—	440	—	200

It is also known from Hampton's early work[7] that thermal shock strength decreases with wall thickness, more or less inversely as the square root of the thickness.

Manufacuring Factors Affecting Resistance to Abuse

The effect of small ridges, discussed above in relation to *design* also carries over into the unintentional ridges due to the limitations of manufacturing. We have in fact already dealt with mold seams, which can hardly be avoided, and infolded fillets. Another item of the same kind is "shear marks" largely controllable by careful operation.

We have also discussed the merits of circular as against non-circular bottles. "Out-of-roundness" can be treated theoretically, on the assumption that the inside and outside of the walls are concentric. It can also be treated on the assumption that they are not concentric, or that they are slightly elliptical.[8] The figures thus obtained attribute a much greater importance to errors of circularity and concentricity than we seem to find in practice[5]; but all these calculations and experiments relate to use, not abuse. When the eccentricity becomes startling, so that there are unequivocally unduly thin spots, the impact resistance falls. Moreover, unduly thin spots may become "checked" in the lehr, or ahead of it, with a great reduction of strength, or the formation of a substantial crack.

Distribution

This brings us squarely up against the problem of distribution, that is the apportionment of the glass to the various parts of the bottle, and its effect upon strength in abuse. In general, given homogeneous glass, and well-designed and well-maintained machinery and molds, it is possible to attain a fair measure of uniformity in the distribution of glass as seen in "ring section," i.e., in a horizontal plane through the bottle. But it is not usually possible, as things stand, to get very good uniformity in a vertical section. This is largely because "glass doesn't like to be thicker than one-eighth of an inch." It is a problem of heat-transfer and "setting-up." The subject is discussed elsewhere by the writer.[3]

Distribution is affected also by design of the "blank," by glass temperature and uniformity of temperature, by the speed of the machine, by the timing of the settling of the blank in the blow mold, and by numerous other factors relating to machine operation which are comparatively well understood. By proper attention to the closing of the blank mold, temperature and other factors, it is usually possible to keep the blank mold seams from blowing thin in the blow mold: by proper control of the timing and temperature, it is possible to keep heel-taps within reason.

The problem of getting enough glass in the necks and shoulders of certain ware is, however, not so easily taken care of. Gravity is against us.

Homogeneity as a Factor in Resistance to Abuse

When glass is lacking in homogeneity (cordy), the bottle made from it is more or less streaky or laminated internally, and the different layers are in varying degrees of compression and tension. This is usually best seen in ring section[9]. If a tension zone is on the external surface of the bottle, the strength of the bottle is reduced by an amount proportional to the tension as ascertained by the G.C.A. standard tests.[1] A quantitative estimate of the seriousness may be obtained by the centrifuge-density-separation devised by Turnbull.[10]

In all these cases, however, it must be remembered that strict homogeneity is not aimed at in bottle glass. It is not practicable to get it, and in moderation it does no harm, because other factors than homogeneity determine the strength of the ware, whether against use or abuse.

Applied Color Lettering

"A.C.L." is a species of cord or heterogeneity deliberately baked on to the outside of a bottle to make it look good. In general it is much to be preferred to raised lettering molded in the glass, so far as resistance to abuse is concerned. The color is "flat" of itself, and in order to apply it, the glass must be free from ridges and stippling, and this is all to the good. Further, in general, the bottles have to be circular and of a generally simple and sound shape. Fancy, "artistic" contortions of the bottle-shape into some resemblance of a coffin or a hunk of masonry are ruled out. The "artistic" needs are met by the decoration, and a simple shape.

The requirements that A.C.L. must meet to safeguard or augment strength have recently been discussed at some length by Ablard.[11] They are somewhat intricate and cannot be summarized here. But the conditions are known and the requirements easily met.

In general, it is not known that A.C.L. has any special influence on strength against *abuse* except its strictly parallel effect on strength for use.

Out of Shape Bottles

At intervals, somewhat long intervals, we have diagnosed breakage in bottles that are not circular when they are intended to be. Wide mouth jars sometimes arrive whose mouths are elliptical. They tend to split vertically through the "finish" on the short diameter of the ellipse, during capping operations.

The same thing is true of occasional narrow mouth bottles, where the finish is substantially elliptical. The crowner breaks them, with vertical splits through the reinforcing ring.

Bottles that have gone out of shape and become "drunk" by overheating in the lehr may likewise collapse in the crowner.

Such oddities as these do not properly belong in a discussion of abuse, because the operations referred to are part of the normal usage of good bottles.

(*Continued on page* 238)

CONFERENCE ON THE PHYSICS OF PIGMENTS AND GLASSES

Minuteness characterizes various subjects discussed. Glass papers deal with atomic distances.

Under the sponsorship of the Department of Physics, University of Pennsylvania, and the Philadelphia District Committee, American Society for Testing Materials, a conference on the Physics of Pigments and Glasses was held on May 15 and 16 at Irving Memorial Auditorium, University of Pennsylvania, Philadelphia, with an attendance of approximately 200. About 25 per cent of the attendance were representatives of the glass industry.

The various subjects discussed were characterized by their minuteness; the pigment papers dealing with particle sizes which approached the wave length of light, the electron microscope paper using microns as a unit of measurement, while the glass papers (not to be outdiminished) dealt with atomic distances.

Four papers were of direct interest to the glass technologist. In the first, Prof. Warren of Massachusetts Institute of Technology reviewed the basic principles involved in the glassy state. Both the method of taking X-ray patterns of glasses and the method of obtaining their radial distribution curves by a Fourier analysis of the X-ray intensity curves was briefly described and illustrated. It was shown that in a soda-silica glass each silicon is tetrahedrally bonded to four oxygen atoms at a distance of 1.62A, the structure being a random silicon-oxygen network type with the sodium ions being situated in the holes in the network. Part of the oxygens are bonded to two silicons and part to only one silicon. These single-bonded oxygens are unsaturated and the sodium ions try to surround themselves by these oxygens.

In the case of the lime-silica system it was shown that by the means of a few simple calculations and a knowledge of the structure the phenomena of immiscibility could be readily explained. Likewise in the case of the system soda-boric oxide such a method of treatment allows an insight into the significance of the various anomalies in this system.

In the paper by Dr. Preston the mechanical properties of glasses were reviewed. In the introduction to the subject the viscous properties were first discussed. In an effort to show that glass at room temperature does not flow like a liquid, the viscosity of a glass at room temperature was given. As the resulting figure was astronomical in character the universe was called upon to illustrate its magnitude. The result was quite convincing.

The mechanical properties of glass and metals were then compared and it was shown that while the theoretical strength of glass is quite high in value actually the measured strength so obtained was only the strength of its surface. It was also shown that glass cannot be broken by compression or by shear but only by tension. When a piece of glass breaks it does not do so all at once as all the cracks are not formed simultaneously. Usually there is a single origin for the fractures and the fractures may travel with velocities varying from zero up to about 5,000 ft. per a second (i.e. about one-third of the speed of sound in glass). In addition each break is similar to a fingerprint and the original cause of fracture can be usually traced when the fragments and fractures are analyzed.

The "time factor" or "fatigue" of glass was also discussed and it was shown that the strength of glass decreased with time. New data in which loading times of micro-seconds were used was presented and the difficulty of testing at longer times was emphasized. A brief report of new data on the variation of strength with temperature was also given. The temperature range used being from below the freezing point of water to above the boiling point of water. Above and below these two fixed points the strength was higher than the strength between the two fixed points and it was concluded that the presence of a water film was responsible for this difference. This water film either reacts with the glass surface or enters into the glass network with the result that the structure is changed and weakened.

In the paper Glass-Pigment Systems, Dr. Robertson of duPont's Ceramic Division discussed the characteristics of enamels and glass colors and the difficulties connected with their manufacture. Typical compositions were shown and the differences between paint pigments and pigments used in a glassy vehicle were discussed. It was pointed out that not only must the color and other properties of the pigment be known but that the color and other properties of the glassy vehicle must likewise be known. In addition the effect of the glassy vehicle on the solution of the pigment must be known. It was emphasized that while two and three component systems may be treated mathematically, systems like glass and enamel colors which may contain from five to ten or more components cannot be treated in this manner and therefore must be investigated by laborious trial and error procedures backed by experience.

Dr. Seitz of the University of Pennsylvania in his paper on the deterioration of materials by light confined the subject to the basic theories of the effect of light on inorganic solids such as paint pigments and glasses. It was shown that in certain crystals spaces or impurities in the crystal lattice will allow the movement of electrons and it is these electrons rather than the neutral atoms that are responsible for the color acquired by the crystals. This phenomena was illustrated by the alkali halides which if heated in an alkali metal vapor will cause the production of color centers by the introduction of electrons into the crystal from the vapor. The effect of light on the silver halides and lithopone and the role of photoconductivity was also discussed.

TOUGHENED GLASS

By J. T. LITTLETON

Reinforced structures are common. The methods used for reinforcing are various and often ingenuous. The application of a tension member to cause compression at another region where the service is severe is one of the favorite methods for increasing strength. The use of spokes in a bicycle wheel is an example of this principle. In order to stiffen the wheel and to strengthen it the required amount, tighten up and a good structure results. If it be tightened too much the spokes may snap and the wheel collapse. If it be tightened unequally the wheel will be warped and no good as a wheel. This simple principle of creating a stronger body by generating an internal tension in order to furnish a region under compression is now being used as a method for strengthening or toughening glass. Since there are no spokes that one can get to inside of the glass, the problem has to be solved by treating the object to be strengthened in such a manner that this process automatically occurs as desired. This can be accomplished by controlling the rate of cooling of the glass from a temperature sufficiently high to render the glass slightly plastic. An internal tension results from such a cooling since during this cooling process the surface of the glass body necessarily becomes colder than the inside of the glass. This would cause a differential contraction of the glass except for the fact that initially the glass is plastic and yields to the stresses set up in such cooling. However, as the glass continues to cool it becomes hard and can no longer yield. Finally as the glass becomes cooled to a temperature near that of the room the difference between the surface and the inside gradually disappears. Since, at the moment the cool outside became rigid, the hotter inside, because of its plastic condition, will contract as its temperature falls, thus creating a strained condition. However, since the body is a continuous solid the outside must from necessity resist the contraction or tension of the inside and hence is compressed and thus toughened; just as the rim of the wheel is stiffened by the tension of the spokes.

Another way of explaining this action is to state that bodies are ordinarily only broken when their surfaces are in a tension exceeding a certain amount. If these surfaces are normally, that is before loading, in a state of compression this compression has to be overcome and then tension built up before breakage occurs. The surfaces are therefore stronger by exactly the amount of the compression introduced by the cooling.

Carefully controlled cooling is an essential part of the process just as controlled or balanced tension in the spokes is necessary in the case of the wheel.

This principle is now being applied to a type of safety glass being used in large quantities in automobile and truck windows. Besides being stronger this glass has for such uses a further advantage in that it is so treated that when broken it breaks into such tiny fragments that a person cannot be dangerously cut by them.

"Pyrex brand Flameware" is another new glass line which is used for top of stove cooking and as a substitute for metal thus releasing metal for defense purposes. These glass articles are toughened in such a manner that they are sufficiently resistant to temperature shocks that they can be safely used over the ordinary domestic stove burners. The treatment given these dishes is such that when they fracture they do not break into tiny pieces as does automobile safety glass but fracture into larger pieces in a more normal manner.

The latest line of toughened glass being marketed is a line of tumblers called "Double Tough." The longer life of such articles in use seems conclusively to prove the fundamental soundness of the principles involved in the toughening process.

ANNUAL MEETING OF SOCIETY OF GLASS TECHNOLOGY HELD AT SHEFFIELD

The 25th Annual General Meeting of the Society of Glass Technology was held at the University of Sheffield, England, on April 15, the president, Dr. S. B. Bagley, F.S.G.T., presiding. Dr. S. English, D.Sc., F.I.C., F. Inst.P., a former president of the Society of Illuminating Engineers and eminent in the sphere of glass technology, was warmly welcomed as the incoming President.

Other officers elected were: Vice Presidents: Miss A. M. Jackson, B.Sc., F.S.G.T., and W. A. Moorshead, A.R.C.S. Members of Council: H. E. Jones, B.A., B.Sc.; J. H. Partridge, B.Sc., Ph.D., F.S.G.T.; E. Seddon, B.Sc., Ph.D., F. Inst.P.; Th. Teisen, C.E.; R. E. Threlfall, M.A. Hon. Treasurer-General: F. G. Orme, O.B.E., F.C.I.S.: American: F. C. Flint, B.S., F.S.G.T. Hon. Secretary: Professor W. E. S. Turner, O.B.E., D.Sc., F.R.S., F.S.G.T.

In his Presidential address Dr. English discussed "The Commercial Use of Scientific Data." Reviewing briefly the development of the science of glass technology in the last twenty-five years, he showed the importance of the results obtained in their application to manufacturing processes. The problem of glare in relation to the adaptability of the human eye to an enormous range of illumination was emphasized, and the properties of diffusing opal glasses in conjunction with metal filament lamps described.

"The Utilization of Low Grade Fuel in Gas Producers" was the subject of a paper presented by M. W. Thring, B.A. Studies made by Dr. Thring showed that intense air blasts introduced by nozzles in small gas producers raise the temperature of the fuel and decrease the amount of unreduced carbon dioxide without causing undue clinker formation. Furthermore, the size of the fuel is important since the smaller the particles the lower is the percentage of carbon dioxide re-formed by combustion of the carbon monoxide in the interstices of the fuel.

USE OF GLASS IN PLACE OF OTHER PACKAGING MATERIALS MAJOR TOPIC AT G.C.A. MEETING

In his annual report to the assembled members of the Glass Container Association, meeting at the Westchester Country Club in Rye, New York, Victor L. Hall, Assistant Business Manager of the G.C.A., after referring to the uncertainty anticipated at the fall meeting in 1941 due to possible difficulties in obtaining the necessary materials, equipment and transportation required to produce and move the volume the industry was capable of turning out, sounded the keynote of the meeting when he stated "Our chief endeavor during this meeting will be to appraise the situation confronting the industry, and to formulate such guidance as is possible for our future course. This will necessarily involve a review of the various presentations made by the Association's committees and the staff to the OPM and later the WPB, as well as the various directives issued by those agencies affecting our industry."

Mr. Hall went on to say that in dealing with the industry's problems at Washington the glass container manufacturers have kept to the foremost the fact that the nation is engaged in the greatest struggle of all times and that the industry did not ask nor expect the allocations of scarce materials to an extent which would impair the production of vital war equipment such as tanks, ships or other instruments of modern warfare. However, with regard to the acquisition of the necessary materials needed by the industry to enable it to make useful the indicated volume of glass containers required Mr. Hall stated, "We have contended that our product is one of the most economical package materials for supplying the nation with its required needs. Further, that if critical materials are available for civilian goods, the principle of providing the greatest quantity of goods with minimum use of such materials be consistently followed."

Working on the premise that the use of critical materials should be based on the principle of providing the greatest quantity of goods with a minimum use of such materials the Glass Container Association is planning a factual presentation to be submitted to the WPB and any other governmental agency concerned which will graphically and statistically show the advantages to be derived by the encouragement of packaging products in glass which are vital to *basic human needs*. The presentation is designed to show the relative consumption of tin and rubber for glass packed products as compared to the same quantity of products packed in tin. Comparative figures will be given for each type of product for which glass is recommended.

The atmosphere of a "war council" was further emphasized by the presence of several government representatives all well known to the glass container industry.

Mr. Edward J. Detgen of the Department of Commerce in a short informal and unofficial talk urged the glassmen to give "their" government all the vital statistics they could muster as they related to the industry's operations and requirements. He stated that the government needed and wanted such information from industry.

Mr. D. M. Gray, on leave of absence from Stoner Mudge Company and serving in the Protective Coatings Branch, spoke on the status of protective coatings for metals. He outlined the position of various types of resins, pigments and stated that several researches are going on for protective coatings. He suggested that the industry study the possibilities of bonderized steel. In closing, Mr. Gray echoed the sentiments of Mr. Detgen in affirming that the government was more than receptive to the presentation of factual data by industry as it related to each industry's particular problems and place in the scheme of things.

At the Wednesday morning session Mr. H. J. Carr presided over a panel discussion at which the speakers were all from the WPB. It should be noted, however, that these government men spoke only as individuals and not in any official capacity.

Mr. John Russell of the Alkali Chemicals Branch, referring to the soda ash situation, stated that the position of the plants in the East and South which serve the bulk of the demands of the glass container manufacturers has been relieved. On the West Coast, however, supply is somewhat tighter but two plant expansions now under way should help materially in alleviating the stringency.

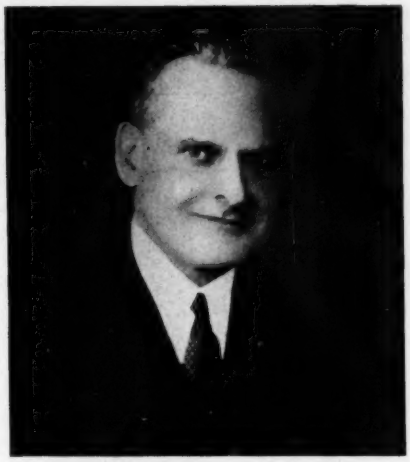
John R. Hostetter, until recently Assistant Editor of THE GLASS INDUSTRY and now Associate Priority Analyst, Glass Unit of the Chemicals and Allied Products Branch, touched on other raw materials that go into the batch, stating that there was little trouble with regard to most of them. He commended the survey of materials undertaken by the Glass Container Association.

Rexford Newcomb, another ex-journalist and now serving with the Bureau of Industrial Conservation, pointed out that his office does not have the same powers of enforcement as other branches. It is a "staff" rather than a line organization, and the work under the present set-up is of an advisory nature. Conservation by substitution is a particular interest of Mr. Newcomb's and this naturally is of paramount interest to glassmen. Referring to glass making materials he told the glass manufacturers to get ready to make flint glass without the use of cobalt as a decolorizer. He also emphasized the general WPB policy of encouraging the stocking up on plentiful materials in order to give some relief to transport facilities later on.

Another government man who needed no introduction to the glassmen was Dr. J. H. Toulouse, now Technical Advisor in the Containers Branch and whose work as Chief Service Engineer, Manufacturing Control Department of Owens-Illinois is well known. As in the case of the other government men who spoke at the meeting, Dr. Toulouse's remarks were entirely unofficial. Nevertheless his discussion covered a great many vital factors affecting the glass container industry. Following is a brief summary of the various points covered.

Although the "glass order" issued by WPB on May 11 is one of the clearest and most explicit to date, Dr. Toulouse made an informal talk regarding some possible interpretations of the Order which may be issued in the next few days.

In reporting Dr. Toulouse's remarks THE GLASS INDUSTRY wishes to emphasize that the information is its own version of what he said and is not to be regarded as "official."



George F. Lang, newly elected president of the Glass Container Association

Lettering. The intent of the order seemingly is that it will not be allowed, with the exceptions of bottle maker's mark and mold numbers, unless such lettering is required by law, as for liquor bottles. Specifically, the user's name should not appear on standardized bottles, except milk bottles, which local laws sometimes require to be identified with the name of the owner.

Changes in weight made necessary by different finishes probably will be allowed.

Liquor finishes. Unless or until plastic becomes the only available closure material, any suitable G.C.A. finish will probably be permitted. It is possible that a system may be worked out later for return and reuse of plastic liquor caps.

Foreign shipments of any bottle are allowed to territory "outside the United States and possessions." This forbids customary shipment of one-trip beers to Alaska, saving ship space, and cut off Puerto Rico and the Virgin Islands as markets for certain bottles used in those markets. It is suggested that Order be made to apply to 48 states and the District of Columbia. The Order ought not to specify the standards of other countries.

Effective date. It may be presumed that a design does not exist until the mold has been cast. Any other interpretation would nullify the effect of the Order in freezing designs.

Duplicate molds. Except as may be prohibited by a schedule, it is fair to assume that glass manufacturers will be allowed to make molds duplicating any bottle in existence before May 11, no matter who first made it, except, of course, non-standard beers or spirits bottles.

Location of spirits indicia. It is understood that new prints are to be issued which will show required position of the lettering on liquor bottles.

Capacity marking. Four times around on a round bottle is the probable limit, and once on each side of a flask, so as to avoid need for facing bottles in labeling operation. The Schedule A prints specifically ban label spotting marks on liquor molds.

Blank molds and neck rings are considered "manufacturing parts" and so not covered by the Order. Can be used for any similar bottle. Order prohibits shapes.

Sample molds would logically be allowed to be extended to full sets only for those bottles that are not prohibited by Order and Schedules.

Weight reduction. It may be assumed that any nonstandard molds can be altered to reduce weight of containers, but that does not mean that new molds can be built to accomplish the same purpose. WPB must be informed if this means a material change in the containers.

Lettering on milks does not constitute new design, if bottle is of permitted shape.

Height of quart beers and ales. These bottles will be shortened in the new prints, making them $11\frac{13}{16}$" high instead of 12". The latter height is too much for some of the existing bottling machinery.

Extension of lines. It presumably will not be permissible to add new sizes of designs allowed to be used under the Order except by the process of formal appeal. Future schedules will set up the sizes to be used in the WPB standard lines.

Duplication of some other company's mold. Probably not allowed because that would mean the building of new molds.

Overflow capacity. Can overflow capacity be changed to accommodate variations in specific gravity of a product? Apparently not. Additional schedules will specify the containers to be used for different products.

One trip beers. Their future after June 30 will depend on the conditions of the industry. If capacity is available they might be continued for a while.

Walter H. McClure, for 10 consecutive years president of the Glass Container Association

With regard to cosmetic and toiletry containers it seems possible that standardization may be avoided to some extent. A limitation of the number of sizes for each group of products is considered possible.

(*Continued on page* 234)

INVENTIONS AND INVENTORS

A Summary of United States Patents of Interest to the Glass Industry Issued During April

Compositions:

Edgar D. Tillyer and Townsend M. Gunn whose phosphate glass patent 2,226,418 was discussed in the February, 1941, GLASS INDUSTRY, have been joined by Harold R. Moulton of Southbridge, Mass., in patent 2,278,501, just issued for similar compositions. In this development program of the American Optical Co., it was found that commercial glasses could be made with 50 to 95% of P_2O_5, together with alkalies, alkaline earths and agents such as alumina and berillium oxide to stabilize the glass against chemical attack. These glasses are said to be colorless and resistant to weathering. The primary use of such glasses is to provide a lens which will have strong absorptive power for infra-red and ultra-violet wave lengths. For these absorptive effects ferrous iron compounds and compounds of the cerium type are used.

To provide glaze colors resistant to the alkalies of solutions which are used for washing milk bottles, Alden J. Deyrup of Elizabeth, N. J. (E. I. du Pont de Nemours & Co.) discloses in patent 2,278,868 the use of compositions comprising 45 to 60 per cent lead oxide, 20 to 30 per cent silica, 0.5 to 10 per cent alkalies, 2 to 11 per cent boric oxide and 1 to 10 per cent zirconium oxide. This type of composition is said to mature "below about 1150° F." to show a glossy surface.

Testing:

Frank W. Preston of Butler, Pa., was granted patent 2,281,324 for an apparatus for testing bottles by impact. The bottle is moved slowly in a lengthwise direction past a point at which impacts are applied by falling steel balls, while the bottle is rotated so that blows are struck at points up and down its length and also around its circumference. By this method it is sought to discover weak spots anywhere in the bottle.

Furnaces:

Fig. 1 shows the batch feeding apparatus for continuous tanks developed by Joseph H. Redshaw of Homestead, Pa. (2,281,050, Pittsburgh Plate Glass Co.). The batch is fed in layers onto the bath by means of the swinging motion of a plate 51 which forms the bottom of the batch hopper. When it withdraws from the extended position it occupies in Fig. 1 the batch falls onto the bath of glass.

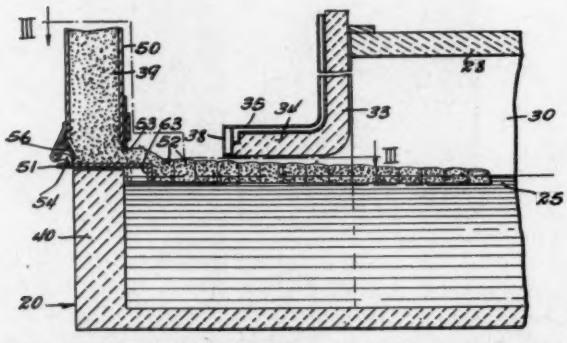


Fig. 1. 2,281,050: Redshaw. A swinging plate 51 charges glass batch in a layer on the glass surface.

Edouard V. Borel, Romont, Switzerland, whose electric glass melting patents issue with such frequency as almost to require the allotment of monthly space in these articles, was the recipient of patent 2,281,408, assigned to Societe Anonyme des Manufactures des Glaces & Produits Chimiques de Saint-Gobain, Paris. Various placements of rod-like electrodes are discussed for discontinuously operated tanks, these being under the glass near the bottom of the bath. In one example the tank is built as a hexagon so that an electrode can extend horizontally across each of three alternating sides, to be fed with three-phase current.

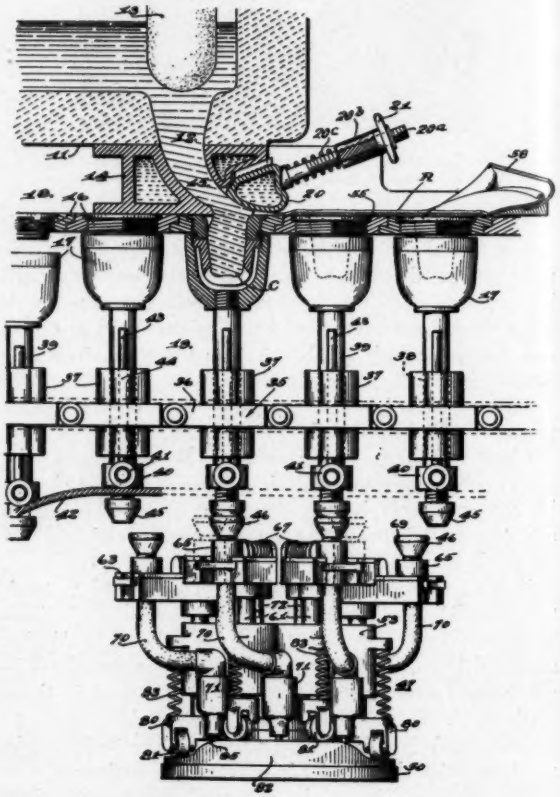


Fig. 2. 2,280,167: Soubier. A forming machine in which plunger 20 strikes off the blank molds and irons out a continuous ribbon of glass.

Feeding, Forming and Shaping:

One aspect of an altogether new principle in ribbon-type continuous forming machines suitable for tumblers is shown in Fig. 2. This view is taken from patent 2,280,167 granted to Leonard D. Soubier of Toledo and assigned to Owens-Illinois Glass Co. The stream of glass from a melting furnace is ironed by tool 20 onto

a conveyor to form a ribbon while charges are drawn by suction through apertures into blank molds 17. A plow 58 separates the moile or ribbon while it is still plastic. The ribbon is merely incidental to the formation of the blank and therefore the steps ordinarily taken to preserve a ribbon of exact thickness and temperature are unnecessary. The ironing process serves to give the charge an initial compacting and to reduce the thickness of the ribbon which is destined to become cullet. The neck rings which support the blanks are part of an endless conveyor. They carry the blanks through a cycle which includes an open air development of the charge by blowing and later a finish blow in finishing molds.

Edwin E. Slick of Pittsburgh received patent 2,278,572 for a continuous method of making milk bottles and similar ware by press and blow operations in a revolving machine. A sheared charge drops into the blank mold where it is pressed by a hollow plunger whose course carries it down through the finish mold which is necessarily aligned vertically with the blank mold; the plunger is then withdrawn carrying with it by suction the formed blank which is blown to final shape in the finish mold after a bottom plate is shifted into place.

Figs. 3 to 5 show George T. Meyers' method of feeding molten glass from a forehearth without using a reciprocating plunger or alternating pressure tube. This is patent 2,280,036 assigned to The Meyers Co., Parkerburg. A refractory tube 12 placed above the orifice is evacuated to start the flowing cycle but thereafter it is the idea to have the vacuum maintain itself. This initial air withdrawal causes the glass to flow into the tube to the high level of Fig. 3, building up a pressure head which will cause a gradual extrusion of glass through the orifice. The downward pull of the glass will form a gob and is said to cause the level in the tube to fall as in Fig. 4. When the gob is sheared the vacuum again draws the glass into the tube and the charge feeding cycle repeats itself. Fig. 5.

As in Mr. Soubier's machine, previously described, the hollow ware forming apparatus of Harold R. Schutz's patent 2,280,268 (Libbey Glass Co.) carries molds on continuous horizontal conveyors. The general layout is

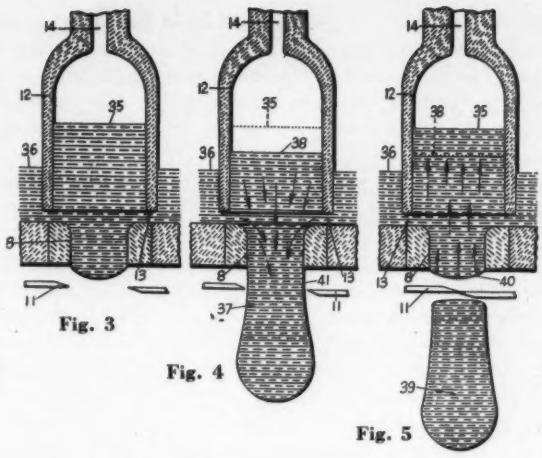


Fig. 3 Fig. 4 Fig. 5

Fig. 3 to 5. 2,280,036: Meyers. Feeding device which operates on a drip principle without alternating the pressure in the tube.

shown in Fig. 6. The blank molds obtain their dome-shaped charges of glass from a forehearth and deposit then on spindles on the upper conveyor which is moving clockwise. The charges are then developed by open blowing until the conveyor inverts them and carries them to a position where the split-section finish molds, 88, close around them. The shaped ware is freed from the finish molds and carried to the top of the spindle conveyor and to a burn-off apparatus shown at the upper left. The tank of water 107 at the bottom is for cooling the finish molds.

Miscellaneous Processes:

Surface treatments for light bulbs and tubes are dealt with in patents 2,280,489 to Frederick Kallus of Hoboken, and 2,280,135 to Theodore W. H. Ward of New York City. The Kallus patent concerns an interior etching to accomplish frosting. Ward's purpose was to provide a metallic conducting coating for the interior walls of radio tubes which would have a matte or non-reflecting surface. His objection to graphite coatings is their

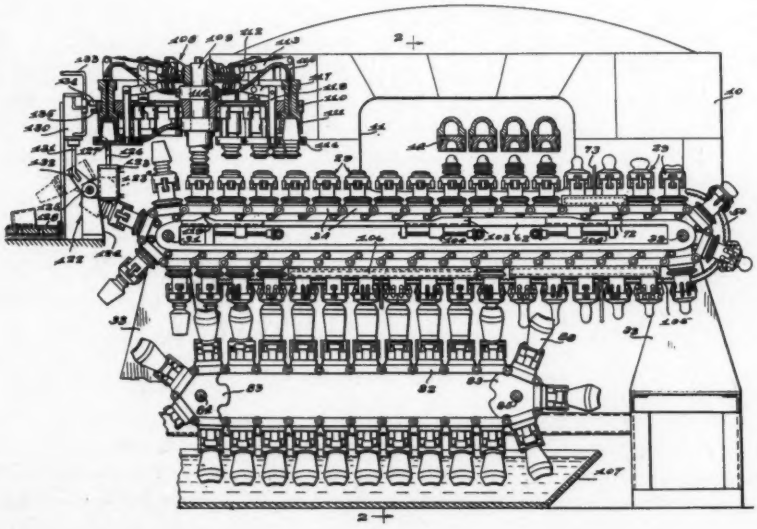


Fig. 6. 2,280,268: Schutz. Tumbler machine in which molds are carried on endless horizontal conveyors.

eventual flaking. Ward uses flakes of such metals as nickel, chromium or silver and applies them dispersed in a volatile solvent also containing a film-forming organic substance. Examples of a solvent and film-former are camphor and toluol.

Methods of sealing metal to glass were described in Westinghouse patents 2,279,818 and 2,279,168 issued respectively to George A. Freeman of East Orange, N. J., and to Philip R. Kalischer and Herman H. Schmitt of Wilkinsburg, Pa. By the Freeman process glass beads are applied to two conductors before they are inserted into a tube; after one is secured in place heat is applied to weld the two beads together and thus to tie both conductors in place. The Schmitt-Kalischer patents describes a technique for producing a glass seal between porcelain and alloys of the Kovar type.

Patent 2,280,306 granted to Harold R. Black of Toledo, and assigned to Libbey Glass Co., concerns the preheating chamber of a decorating lehr. He pays particular attention to the provision of sufficient fresh air to prevent the bloom or surface deposit which may form on the ware due to the incomplete oxidation of the oils and resins present in the decorating coatings.

Cartwright-Turner Anti-Reflection Films

The use of non-reflecting glass enters into all discussions of the post-war automobile. To date such surface coating processes as the Cartwright-Turner process are applied only to articles of small dimension. When light passes through a glass plate a considerable loss occurs at each surface due to reflection, which for a lime glass with an index of refraction of 1.52 would constitute 8.6 per cent of the total light. The loss is addative for the additional surfaces of a multiple lens system. In a camera the situation is especially bad since some of the reflected light produces a flare pattern or even a ghost image. Reflection is reduced by applying thin transparent films which have an index of refraction lower than that of the glass. The conditions for best results were outlined in patent 2,207,656 (assigned to Research Corp.) in 1940 to Charles H. Cartwright, now of Corning and Arthur F. Turner of Newton, Mass. This patent is now reviewed because of the issuance April 21 of a reissue patent No. 22,076, and the appearance a week later of two more patents 2,281,474 and 2,281,475.

A homogeneous film that reduces reflection to zero for one particular wave-length of light must satisfy two conditions: (1) the index of refraction must be equal to the square root of the glass, and (2) it must have an optical thickness of one-fourth of the incident light. The reasons for these requirements were explained by Turner in the June, 1941, GLASS INDUSTRY, pages 255-258. Although neither of these conditions is easily met, Cartwright and Turner, working with metal fluorides have been successful in arriving at a commercially practical solution.

The lens to be treated is confined in an evacuated chamber which contains a heating element from which such a substance as lithium fluoride is evaporated and allowed to form a film on the glass surface. In a typical example the reflectivity of a 1.52 index lime glass was reduced from 8% to 0.4%. The patent reissue was apparently for the purpose of including six claims omitted from the original patent which describe the method of controlling the film thickness. The vapor deposition must be stopped at just such a point as will provide a thickness meeting requirement 2 as stated above. The inventors mention that the point of minimum reflection power could be detected by electrical instruments during evaporation, but that they have learned to detect this end point by color changes.

The thickness of the film is judged by observing the characteristic color changes which occur when daylight is reflected from the film-coated surface. Best conditions for elimination of reflection of daylight occur in the case of a glass having a 1.52 index of refraction, when daylight reflected from it appears purplish. This effect would be noted when the desired film thickness was obtained. A slight additional thickness would show up by a color change in the reflected light from purple to blue. To avoid over-shooting the mark, a monitor or control piece is placed slightly closer to the vapor source than the lens being treated. When the color of the control changes to blue the lens is just short of the blue point and the process should halt.

One of the new patents, 2,281,474 introduces the idea of using two or more films instead of one. The film adjacent to the glass may have a high index of refraction but the resultant effect of the several layers must be to give minimum reflectance. An example is zinc sulphide and silica deposited in this order. This is said to give a surface which is sufficiently rugged to withstand vigorous brushing with a soft brush.

This presents a major limitation of all anti-reflection films which limits their utility: their lack of ruggedness or abrasion resistance. The other current Cartwright-Turner patent 2,281,475 is aimed at this deficiency. They have found that the metal fluoride layers are more rugged and tenacious if they are baked at a temperature between 300° and 500° C.

Sheet and Plate Glass:

The complete extinction of light when two polarized sheets are crossed so that their "optical slots" are at right angles introduces the possibility that our homes may some day be equipped with windows which can be darkened without the use of shades. This is seemingly the idea germ back of the latest Polaroid patent 2,281,112. Wm. H. Ryan of Cambridge, Mass., the inventor, describes his new article as a variable density window. In a window made of three polarizing glass sheets the turn of a knob shifts their relative positions and varies the amount of light transmitted.

Fig. 7 from patent 2,279,112 shows the arrangement of rolls by which John L. Drake and George B. Watkins of Toledo (Libbey-Owens-Ford Glass Co.) complete the sealing of multiple layer laminated glass. The use of occasional large rolls to smooth out the plastic layers would give unequal pressure which would result in an undesirable amount of flexing of the glass sheets. In the Drake-Watkins apparatus there are numerous small

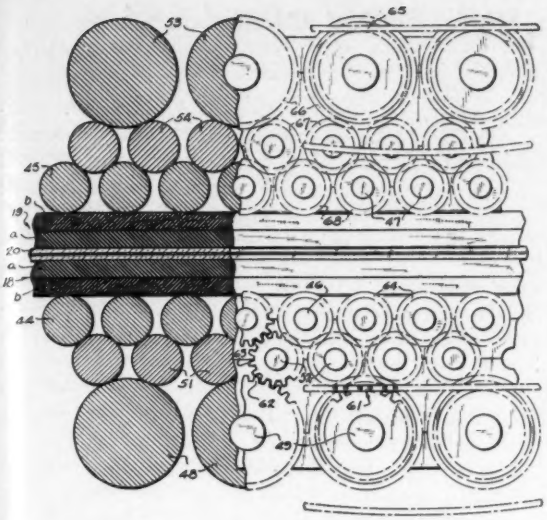


Fig. 7. 2,279,112: Drake and Watkins. Pressing laminated glass together with a block of small rolls backed up by larger and more rigid rolls.

rolls 44, 45, which are only about an inch in diameter. They are kept from bending by other rolls 54 on top of them which receive pressure from still another set of back-up rolls 53 which are much larger.

In patent 2,279,145 assigned to the same company by Joseph D. Ryan of Toledo, glass sheets are bonded by a synthetic resin layer "composed of the resinous product formed by the reaction of an aldehyde on partially or wholly hydrolyzed polymerized vinyl ester plasticized with a butyl of diethylene glyco ester."

A market has been estabished for a decorative laminated product made by sealing glass to a wood having well developed grain. To prevent change in the wood when the sandwich is subjected to heat and pressure for sealing, Brook J. Dennison of Aspinwall, Pa., suggests in patent 2,281,027 that the panel be backed with metal foil and that this sheet as well as the sheet of plastic extend beyond the edges of the wood so that they may be sealed together to form an envelope which will prevent leakage to the wood. These overhanging foil and plastic edges would be trimmed off after the bonding step. This patent was assigned to Pittsburgh Plate Glass Co. as was Arthur D. Nash's patent 2,281,076 for a mirror-like glass. He has found that the reflecting power of sheet glass containing a small percentage of silver nitrate may be improved by subjecting the annealed sheets to a reheating treatment in a reducing atmosphere.

Patent 2,281,483 to Donald E. Edgar of Philadelphia, assigned to E. I. duPont de Nemours & Co., describes a laminating process using a cellulose nitrate adhesive.

Glass Wool and Fiber:

An Owens-Corning Fiberglas electric furnace designed for melting glass for fiber manufacture, but useable for other purposes, is illustrated in Fig. 8, which is taken from patent 2,280,101 to Games Slayter, Flavius W. Atkinson, Ed Fletcher and Harry V. Smith of Newark, Ohio. Since glass may be considered a conductor of electric current when melted but a non-conductor before melting, they use two different heating methods to suit these two conditions. First they establish an arc between an upper electrode 26 and an intermediate electrode 25, then feed raw material around the upper electrode and into the zone of the arc to heat the material to a temperature at which it will conduct electric current; then current is passed through a second circuit including the intermediate electrode 25, a bottom electrode 24 and the heated material forming a resistor, to heat further and refine the glass by the heat generated in it by the current.

Ralph C. Newman of Corning and John W. Romig of Rumford, R. I., received a reissue (22,078) of their patent 2,202,118 relating to the formation of a sliver of fibers. This is an Owens-Corning Fiberglas patent.

Patent 2,280,388 to Daniel C. Drill of Wabash, Ind. (American Rock Wool Corp.), describes a method of blowing an adhesive coating onto newly formed mineral wool fibers.

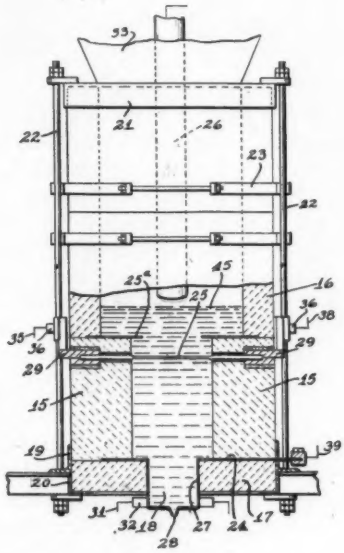


Fig. 8. 2,280,101: Slayter et. al. Electric melting furnace having an arc between electrodes 26 and 25 to melt the raw material and another heating circuit between electrodes 25 and 24 for fining.

Miscellaneous Products:

Window construction is dealt with in patents 2,280,389 to Harold Edwards, Syracuse, N. Y. (The O. M. Edwards Co.), 2,278,694 to Wm. B. Firner of Detroit (General Motors), 2,279,171 to Clyde D. Lowry of Toledo (Libbey-Owens-Ford), 2,281,064 and 2,281,071 respectively to Oscar D. Englehart of Brackenridge, Pa., and Percy E. Knudsen (both Pittsburgh Plate Glass Co.).

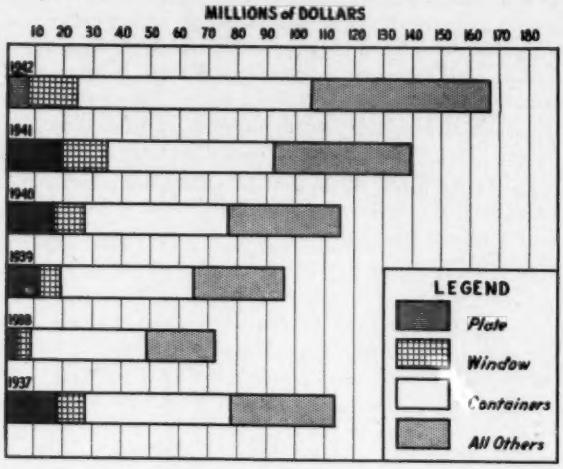
Mr. Knudsen received another patent 2,281,072 for a building wall which uses a panel of glass blocks of special design.

Patent 2,281,524 to George T. Meyers of Parkersburg (The Meyers Co.), describes a glass block molded in one piece and having prism-like surfaces. A mold for forming blocks with a glass face plate was patented by Erle T. Putnam of Detroit. This is patent 2,279,178 assigned to Libbey-Owens-Ford Glass Co.

CURRENT STATISTICAL POSITION OF GLASS

THE GLASS INDUSTRY'S INDEX

Production Through April



During April glass production continued at the high rate established in March as employment and payrolls maintained record levels. According to THE GLASS INDUSTRY'S Production Index, glass output during April amounted to approximately $43,000,000 as compared to $37,000,000 in last year's corresponding month. During the first four months of 1942 glass production totalled $167,000,000 as compared to $139,000,000 in last year's comparable period.

Plate glass production during April totalled 5,569,949 square feet, according to the Plate Glass Manufacturers of America. This was equal to the March total but was 70 per cent less than in April 1941. During the first four months of 1942 production of plate glass totalled 25,877,000 square feet as compared to 71,625,000 square feet in last year's comparable period—a decline of 64 per cent.

Window glass output during April totalled 1,643,656 boxes which was 4 per cent greater than the previous month and exceeded April 1941 by 17 per cent. During the first four months of 1942 this production amounted to 6,322,000 boxes as compared to 5,775,000 boxes during the same months of 1941—an increase of 9 per cent. The window glass industry operated at 101.3 per cent of its rated capacity during April.

Glass container production during April totalled 6,921,145 gross according to the Glass Container Association of America. This about equalled the March total and was 30 per cent greater than the April 1941 output. During the first four months of 1942 glass container production amounted to 26,578,778 gross—38 per cent more than the comparable 1941 figure.

Shipments of glass containers during April totalled 6,829,655 gross which was 23 per cent more than 1941's corresponding figure. All types of containers with the exception of pressure and non-pressure ware and liquor ware moved in larger quantities compared with April last year. The greatest gains were reported for domestic fruit jars (up 222 per cent), domestic jelly glasses (up 124 per cent), beer bottles (up 118 per cent), narrow-neck food containers (up 62 per cent), pressed food ware (up 45 per cent), wide mouth food containers (up 39 per cent); increases ranging from 3 to 15 per cent were reported for other lines. Total shipments for the first four months of 1942 amounted to 25,920,978 gross which was 36 per cent greater than during last year's comparable period. Increases were reported for all lines without exception as follows: domestic fruit jars 434 per cent, domestic jelly glasses 235 per cent, beer bottles 159 per cent, narrow neck food containers 81 per cent, wide mouth food containers 37 per cent, liquor ware 23 per cent, medicinal and toilet ware 20 per cent, pressed food ware and general purpose ware 17 per cent, milk bottles 13 per cent and pressure and non-pressure ware 11 per cent.

Inventories of glass containers as of April 30, 1942 totalled 9,417,266 gross—2 per cent below the 1941 level. Decreases were reported for all lines with the exception of wide-mouth food jars, liquor ware, medicinal and toilet ware, and milk bottles.

Miscellaneous glass products manufactured during

CURRENT GLASS CONTAINER STATISTICS

(ALL FIGURES ARE IN GROSS)

Types of Ware	*Production*		*Shipments*		*End of Month Stocks*	
	April, 1942	*April, 1941*	*April, 1942*	*April, 1941*	*April, 1942*	*April, 1941*
Food Containers (Narrow neck, wide mouth, and pressed)	2,092,195	1,347,096	2,058,192	1,436,191	2,079,501	1,997,240
Pressure and Non-Pressure	420,487	492,908	478,667	633,053	609,092	890,324
Beer Bottles	902,702	489,492	868,466	418,267	352,457	867,220
Liquor Ware	953,753	811,442	837,692	861,180	1,765,848	1,440,450
Medicine and Toilet Ware	1,730,545	1,504,616	1,757,348	1,521,684	3,154,842	3,005,510
General Purpose Ware	447,072	390,033	448,070	406,872	528,221	580,174
Milk Bottles	243,215	231,592	233,896	227,671	399,074	294,791
Fruit and Jelly	108,481	23,451	125,237	40,694	481,727	492,959
All Other	22,695	31,077	22,077	23,889	46,504	43,529
Total Industry	6,921,145	5,321,707	6,829,655	5,569,501	9,417,266	9,612,197

April were valued at $16,000,000, according to reliable estimates. This compared with $13,000,000 in April 1941.

According to a preliminary report of the Bureau of Census, 12 illuminating glassware manufacturers reported sales totalling $808,000 during April which was 13 per cent more than in April 1941 and 10 per cent greater than the March 1942 figure.

Manufacturers sales of machine-made table, kitchen and household glassware were reported to have totalled 2,876,093 dozens in April which was 27 per cent less than in last year's comparable month. During the 12 month period ending April 30, 1942 this trade increased 11 per cent over the previous 12 months to 38,395,280 dozens.

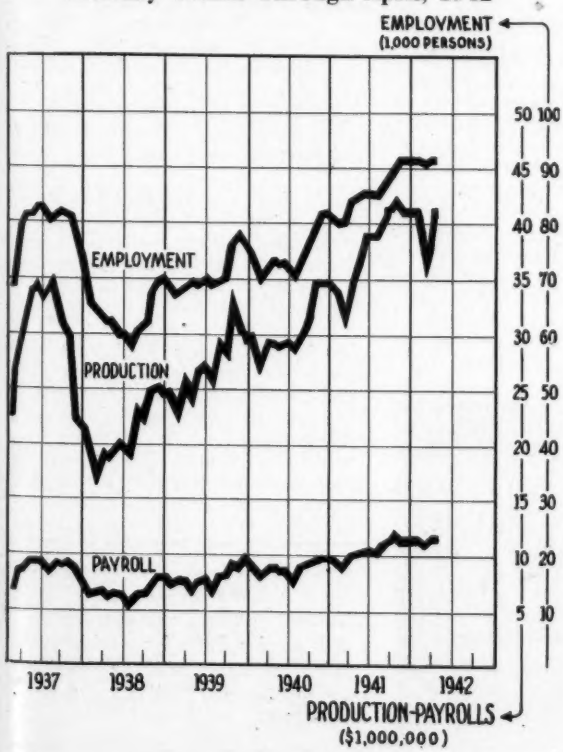
Employment and Payrolls: Employment in the glass industry during April amounted to approximately 92,000 persons or about equal to the March figure. This compared with approximately 85,000 persons in April 1941.

Payrolls in the glass industry during April were estimated at $12,500,000 or equal to the March figure. In April 1941 these payrolls were estimated at $10,500,000. During the first four months of 1942 glass manufacturers paid out over $48,000,000 in wages; last year's comparable figure was $40,000,000.

Shipments of automatic tumblers during April totalled 4,609,594 dozens or 5 per cent above April of last year. During the 12 months ending April 30, 1942 these shipments amounted to 53,037,541 dozens—an increase of 23 per cent.

GI THE GLASS INDUSTRY'S INDEX

Monthly Trends Through April, 1942



GEORGE S. COOPER ELECTED EXECUTIVE VICE PRESIDENT

At the meeting of the Board of Directors of the Diamond Alkali Company, held May 4th, Mr. George S. Cooper was elected the Executive Vice President.

Mr. Cooper has been interested in the sale of Diamond products either with the Sales Department of the Company or with one of its associates since 1919. For the past five years he has been Vice President in Charge of Sales with his office in Pittsburgh where he will continue in his new position.

• R. W. Miller of the Pittsburgh Plate Glass Company has been appointed manager of the technical service department of the Columbia Chemical Division to succeed Dr. G. L. Cunningham who has resigned. Mr. Miller, associated with the company for twelve years, has been engaged in technical service activities since 1937.

BOOK REVIEW

"Manufacture of Soda"
by
Te-Pang Hu, Ph.D.

This is one of the American Chemical Society Monographs; the first edition appeared in 1932 or thereabouts, and the second appears ten years later. This seems a sufficient interval of time, for not many industrial processes remain without very substantial improvements and modifications for so long as a decade.

In this country, the manufacture of Soda Ash is in the hands of a very few companies, each of which seems to exercise more than ordinary care about its trade secrets. It is therefore not very practicable to have the book reviewed by those who know most about the subject. At the present time it is doubly impracticable, for any criticism of Te-Pang Hou's reports would necessarily indicate where progress has been made, and guide the nations with which we are at present at war; if these improvements have been substantial, then, since Soda is the basis of the whole Chemical Industry, any useful disclosures would augment the war effort of our enemies. In other words, the book appears at a time when a serious review of it would be a serious mistake.

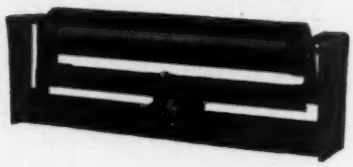
The book in question is the best book on the subject in the English language: it is also, to all intents and purposes, the only book, and is therefore a classic. It is not likely that there will appear any competitor of it for some time to come, and it is therefore required reading for those concerned with heavy chemicals. No review, favorable or otherwise, can affect this situation.—*Reinhold Publishing Corp. Second Edition* 1942. $9.50.

F. W. PRESTON

NEW EQUIPMENT AND SUPPLIES

SELF-ALIGNING IDLER

Recently announced by the Chain Belt Company is a self-aligning idler for flat conveyor belts so constructed as to keep the belt central on all its idlers, an important element for the longest possible life from a conveyor belt. The new idler, known as the REX, is a sturdily built unit and follows the principle of construction used in the REX self-aligning troughing idlers which have been very successful. Side guide rolls are eliminated to avoid unnecessary wear.



pH TESTS SIMPLIFIED

Designed for control tests in the plant by unskilled workmen and also for quick preliminary laboratory tests, the use of Cargille Buffer Set No. 1 with Hydrion Wide-Range pH Test Paper provides a simple means of making pH tests. Solutions of known pH, made by dissolving the tablets in this set, are applied to the test paper to bring out on the paper the color for any half unit from pH 3 to pH 11. The colors are used for reference to judge the pH of the sample being tested; comparisons with these reference colors are said to be more accurate than those made with color charts. Readings can be made to one-half pH unit.

BEESWAX SUBSTITUTE

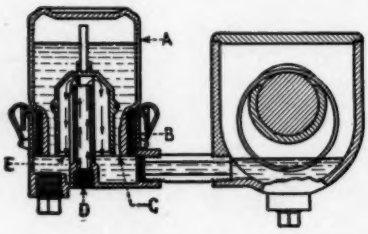
Innis, Speiden & Company of New York announce that their laboratories have developed a Beeswax Substitute having many of the chemical and physical characteristics of the imported and refined Yellow Beeswax. This substitute is recommended for all industrial purposes.

CONSTANT LEVEL LUBRICATOR

Recently put on the market is the Oil-Rite Constant Level Lubricator, which it is claimed will maintain a constant pre-determined level of lubricant by automatic control and also prevent oil waste and deterioration of material caused by oil throw. The manufacturer emphasizes that because the operating principle provides large size, separate passages for air and oil the flow of lubricant is not restricted in any way.

The base of the Oil-Rite lubricator is cast of Zamak metal with a vent extending into the oil resevoir. Over the vent is a loosely fitted bell. The resevoir is a glass dome sealed to a metal collar by plastic porcelain cement. Two spring clips lock the oil resevoir in position. A gasket around the outside of the bell prevents waste of oil during refilling.

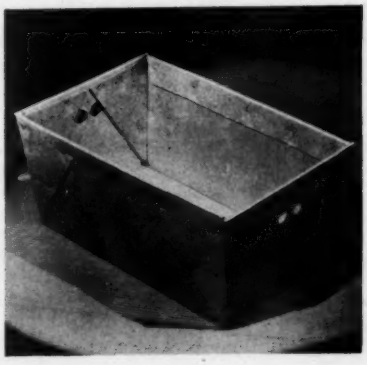
The diagram illustrates the operation of the lubricator. When the resevoir (A) is filled and inverted on the base (B), the lower edge (E) of the bell determines the oil level which the lubricator will maintain. When the level falls below this point, air from the vent (D) escapes under the side of the bell —as at (C)—up to the top of the lubricator, permitting oil to flow down until the level to be maintained again seals across the base of the bell. When used on machines that operate intermittently, the chamber formed inside the bell provides adequate surging capacity for oil flowing back to the lubricator.



CORRUGATED TOTE BOXES

To relieve metal shortages corrugated tote boxes have been found highly satisfactory by many war manufacturers for small parts on the assembly line and in storage. The box illustrated is one of several basic types designed by The Hinde & Dauch Paper Company.

The use of corrugated tote boxes, trays and bins, while by no means new in the industry, are becoming increasingly popular since the lighter weight of the board is a definite advantage to women workers. Injuries to workers' fingers, caused by sharp edges and splinters, are entirely eliminated.



CATALOGS RECEIVED

Leeds & Northrup Company, Philadelphia, Pa. The spring edition of "Modern Precision," supplementing L & N regular catalogues, contains news of instruments, controls and heat-treating methods, and the jobs they are doing in the industry and in research laboratories.

Mathieson Alkali Works, Inc., New York City. Published in commemoration of its 50th anniversary, "Fifty Years of Chemical Progress," an attractive 48-page illustrated booklet, traces the growth of the organization and describes its major developments.

B. F. Goodrich Company, Akron, Ohio. "Care and Maintenance of Conveyor and Elevator Belting" is a 24 page booklet giving thorough coverage of belting problems. Included are specific instructions for the care of belting, a wide range of belt data, and tables and formulas for use in calculation of belt requirements.

Metallizing Engineering Co., Inc., Long Island City, N. Y. Bulletin 42-A describes the metallizing process and equipment for its application. Tells briefly how replacements are being eliminated in essential industries and service-life of equipment increased.

Brown Instrument Company, Philadelphia, Pa. Revised Catalogue No. 1105 on Brown Potentiometer Pyrometers will be found useful to anyone interested in indicating, recording and controlling temperatures. Presents clear and concise information on design and operating features of various models and accessory equipment.

Toledo Scale Co., Toledo, Ohio. A new brochure entitled "Looking In on Honest Weight," giving a pictorial survey of the human and mechanical resources back of the making of the modern precision scale.

American Foundry Equipment Co., Mishawaka, Ind. A 58 page revised catalogue describing fully American "Dustube" Dust Collectors, Knock-down and Assembled types. Prepared as a manual for plant engineers, includes practical data for applications of dust control units.

CATALOG & BULLETIN SERVICE

Current catalogs and manufacturers' service bulletins reviewed in this department may be obtained by writing to THE GLASS INDUSTRY.

CURRENT PRICES OF GLASS-MAKING MATERIALS

FURNISHED BY PRODUCERS, MANUFACTURERS AND DEALERS

Base Materials

		Carlots	Less Carlots
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	....	....
Precipitated material		55.00	60.00
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk f. o b shipping point	ton	15.00–16.00	18.00
Borax ($Na_2B_4O_710H_2O$)			
Granulated	In bulk, ton	42.50	....
Granulated	In bags, ton	46.00	57.00–62.00
Powdered	In bags, ton	51.00	62.00–67.00
Boric acid (H_3BO_3)			
Granulated	In bulk, ton	96.50	
Granulated	In bags, ton	100.00	112.00–117.00
Calcium phosphate ($Ca_3(PO_4)_2$)	lb.	.07	.07⅛
Cryolite (Na_3AlF_6) Natural Greenland (Kryolith)	lb.	.09½–.09¾	.10
Synthetic (Artificial)	lb.	No supplies available.	
Feldspar—(published list prices)			
20 mesh	ton	11.00–13.25	
40 mesh	ton	11.50–13.75	
Granular	ton	11.75–14.00	
Semi-granular	ton	11.00–13.25	
L. C. L., (Min. 2 tons) $3.00 per ton additional plus charge for bags.			
Fluorspar (CaF_2) domestic, ground, 96–98% (max. SiO_2, 2½%)			
Bulk, carloads, f. o. b. mines	ton	34.00	....
In bags	ton	36.40	50.00
Kryolith (see Cryolite)			
Lead Oxide (Pb_3O_4) (red lead) (N. Y.)	lb.	.0900	....
In 5 Ton lots	lb.	....	.0950
Less than 5 Tons	lb.	....	.10
Lime—			
Hydrated ($Ca(OH)_2$–MgO) (in paper sacks)	ton	8.50	8.50
Burnt (CaO–MgO) ground, in bulk	ton	7.50	....
Burnt, ground, in paper sacks	ton	9.50	9.50
Burnt, ground, in 280 lb. drums	Per drum	2.35	2.35
Kiln Dried ($CaCO_3$–$MgCO_3$) 10x30 mesh	ton	2.00	....
Kiln Dried ($CaCO_3$–$MgCO_3$) 16x20 mesh	ton	2.00	....
Nepheline Syenite, f. o. b. shipping point	ton	13.00	16.50
Potassium carbonate—			
Calcined (K_2CO_3) 96–98%	lb.	.065	.0675
Hydrated 80–85%	lb.	.055	.0575
Salt cake, glassmakers (Na_2SO_4) in bags	ton	21.00–22.00	28.00–30.00
in bulk		17.50	
Soda ash (Na_2CO_3) dense, 58%—			
Bulk	Flat Per 100 lb.	.95	....
In barrels	Per 100 lb.	1.35	....
In Paper bags	Per 100 lb.	1.10	
In Burlap bags	Per 100 lb.	1.15	....
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls. 95% and 97%	Per 100 lb.	....	3.00–3.40
Bulk	Per 100 lb.	1.35	3.60–4.00
200 lb. bags		1.4675	1.48
100 lb. bags		1.475	1.50

Special Materials

		Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)	lb.	.031–.034	.045
Aluminum oxide (Al_2O_3)		.07	.09
Antimony oxide (Sb_2O_3)	lb.	.15	.15½–.16½
Arsenic trioxide (As_2O_3) (dense white) 99% In barrels		.04½	.04¾
Barium nitrate ($Ba(NO_3)_2$)	lb.	....	Open price.
Pyrophyllite (20% Al_2O_3)	ton	10.00	13.00
Sodium fluosilicate (Na_2SiF_6)	lb.	.09½	.12½
Tin Oxide (SnO_2) in bbls.	lb.	....	Open price.
Titanium Oxide (ceramic grade)			
In bags	lb.	.14½	....
In barrels	lb.	.14¾	....
Zinc Oxide (ZnO)			
American process, bags	lb.	.07¼	.07½
White Seal, 150 lb. bbls.	lb.	.09¾	.10
Green Seal, bags	lb.	.09	.09¼
Domestic White Seal, bags	lb.	.09½	.09¾
Red Seal, bags	lb.	.08½	.08¾
Zircon			
Refined Granular (Milled .01–.02c higher)		.06½	.07–.08

Coloring Materials

		Carlots	Less Carlots
Barium selenite ($BaSeO_3$)	lb.	....	1.40–1.60
(Commercial, 25% Selenium)	lb.	....	.85
Cadmium sulphide (CdS)	lb.	....	1.10–1.15
Cerium hydrate—			
100 lb. drums and 600 lb. barrels	lb.	....	.65
Chrome Oxide Green, 400 lb. bbls.	lb.	....	.25–.28
Chromite (99% through 200 mesh)	ton	58.25	64.75
Chromite ore (air floated)	ton	58.25	64.75
Cobalt oxide (Co_2O_3)			
In bbls. 350 lbs. or more,	lb.	....	1.84
Less than 350 lbs.,	lb.	....	1.94
Copper oxide—			
Red (Cu_2O)	lb.	....	.20–.22
Black (CuO)	lb.	....	.19–.22½
Black prepared	lb.	....	Open price.
Iron Oxide—			
Red (Fe_2O_3)	lb.	....	.06½–.10
Black (Fe_3O_4)	lb.	....	....
Iron Chromate	lb.	....	.035–.05
Lead Chromate ($PbCrO_4$) in bbls.	lb.	....	.16½
Lithium Carbonate	lb.	....	1.25
Manganese, Black Oxide African			
In Paper bags	ton	70.00	78.00
In Burlap bags	ton	71.75	79.75
In Casks	ton	74.00	82.00
Neodymium oxalate, 50 lb. drums	lb.	....	4.00
Nickel oxide (Ni_2O_3), black	lb.	....	.34–.40
Nickel monoxide (NiO), green	lb.	....	.35–.37
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals and Granular	lb.	.09½	.09¾–.10
Powdered	lb.	....	.10¼–.10½
Potassium Chromate (K_2CrO_4) 100 lb. kegs	lb.	....	.27
Powder blue	lb.	....	.21–.25
Rare earth hydrate—			
100 lb. drums	lb.	....	.35
325 lb. barrels	lb.	....	.30
Selenium (Se) in 100 lb. lots	lb.	....	1.75
In lesser quantities	lb.	....	1.85
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07¼	.07½–.07¾
Sodium chromate (Na_2CrO_7) Anhydrous	lb.	.08⅝	.08⅞–.09⅛
Sodium selenite (Na_2SeO_3)	lb.	....	1.50–1.65
Sodium uranate (Na_2UO_4) Orange	lb.	....	1.65
Yellow	lb.	....	1.65
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.40	3.75–4.15
Flowers, in bags	Per 100 lb.	3.05	3.40–3.80
Flour, heavy, in 250 lb. bags	Per 100 lb.	2.95	3.30–3.70
Uranium oxide (UO_2) (black, 96% U_2O_6)			
100 lb. lots. Black	lb.	....	2.55
Yellow orange	lb.	....	1.65

Polishing Materials

		Carlots	Less Carlots
Emery, Turkish	lb.	.075	.08
Pumice Stone,			
American Ground FFF, FF, F	lb.	.03	.04
0, 0½, ½, 1	lb.	.05¾	.05¾
Putty Powder	lb.	Open price.	
Rotten Stone (Domestic)	lb.	.02¼	.03½
Rouge, Red	lb.	.18	.16
Black	lb.	.15	.18

USE OF GLASS . . . TOPIC AT G.C.A. MEETING

(*Continued from page* 225)

Dr. Toulouse mentioned several needs important from a standpoint of materials conservation. Such things as closures requiring very little metal or containing no metal at all and limitation of the number of sizes. Substitutes for cork and rubber, all-glass closures for containers and lacquer for blackplate to replace tin.

Answering questions from the floor, he said that the effective dates of future standardization orders will be staggered so as to avoid an excessive order on mold makers who are heavily engaged in war work. Asked about the allowance of time for closure manufacturers to get ready to make the required sizes, he said that orders are not intended to be punitive and that appeals are in order, especially if they will save materials.

In the course of his talk Dr. Toulouse paid a high tribute to Philip S. Hardy, the new chief of the glass section in the Container Branch.

Closing the WPB symposium, Mr. Carr announced that an order was momentarily expected fixing the monthly use of blackplate for beverage and beer crowns at 60 per cent of the tonnage used in the same month of 1941. This means that the beverage industry can operate at a rate not exceeding 70 per cent of 1941 until further notice. The difference in the two percentages is accounted for by the fact that 90 lb. plate will be used instead of 103 lb. The order referred to is an amendment to M-104, and it became effective May 30.

Mr. Carr also reported that the latest restriction on use of metal in liquor closures will give the industry the right to have a three months' inventory of metal caps on August 1. After the supply is exhausted (presumably before November 1) there will be no more metal caps for liquor. The three months' supply is based on metal consumption in May, June and July of 1941.

There are now three restrictive orders on glass container closures and more expected. They will be more specific as to products that can be allowed to have tin, steel and rubber. Phenolic plastics are not now available, and urea resins are going to be affected by the coming ammonia order.

Mr. Carr said that the present A-1-a priority rating on closure metal for foods, medicines and chemical products is rather high. At the same time, the plastic closure rating of B-4 is too low. The ideal is a rating high enough to get the material after taking care of real war production needs. He saw little trouble in the materials side of the glass manufacturing picture. Cobalt, of course, is going out, and chrome too, unless waste ores can be processed. Arsenic is wanted by the chemical warfare service. It is to be hoped that cullet will become more available.

Mr. Carr intimated that closure manufacturers may find it necessary to come under the production Requirements Plan. There is no order requiring this, but it will be necessary in order to get metal. Sooner or later glass manufacturers, too, may have to go under it and report their usage of materials each month. If all go under the plan it will help to get uniform treatment of the industry. Mr. Carr suggested that in filling out the PRP forms it is a good thing to add a classification for "miscellaneous" if there is any material used that is not listed elsewhere, and put the use of the material under that heading. He said it is best *not* to read the instructions accompanying these forms, because they will prove very confusing. Just start filling out the form and refer to the instructions if necessary as you go along.

Mr. Joseph C. Feagley as Chairman of the Defense Committee briefly reported some of the activities of his committee. He discussed the idea of whether an advisory committee meeting should be called by contacting T. Spencer Shaw of the War Production Board who arranges such meetings. The committee would be comprised of Mr. R. H. Barnard of Owens-Illinois Glass Company, Mr. E. J. Costa of Crown Cork & Seal Company, and Mr. J. M. Foster of Foster-Forbes Glass Company.

With further reference to the glass container industry's activities in Washington Mr. Stevenson announced with regret that Mr. H. J. Carr who has so ably handled the industry's problems in Washington had resigned his post. His work will be taken over by Mr. Harry Kuni who has been effectively carrying on the Association's statistical work formerly handled by Mr. Hall prior to his appointment as Assistant Business Manager of the G.C.A. In announcing Mr. Kuni's appointment as the G.C.A.'s Washington representative, Mr. Stevenson pointed out that it was a tough assignment they had given Harry Kuni but was glad to say that his task might be eased to some extent by the fact that "Doc" Carr had agreed to stay on for a short period and collaborate with Mr. Kuni in his new work.

Aside from the effect of the war on the glass container industry's plans and operations the program of the meeting followed the usual pattern. Mr. Hall's detailed report of the affairs of the Association, the election of a president and directors, golf tournament, entertainment, etc.

With regard to the Association's executive set-up the outstanding news was the election of Mr. George F. Lang, President of the Carry-Lowrey Glass Company, as president of the Glass Container Association. Mr. Lang succeeds Mr. Walter H. McClure who has diligently served as president of the Association for ten consecutive years.

Mr. I. R. McDonald of the Dominion Glass Co., Ltd., was elected 2nd Vice President succeeding Mr. C. D. King of Anchor Hocking Glass Corporation. Five directors, Mr. C. R. Avery, Chattanooga Glass Company; Mr. F. L. Lloyd, Crown Cork & Seal Company; H. C. Mandeville, Thatcher Mfg. Company; F. J. Petty, Ball Brothers Company, and Mr. J. H. Rau, of Fairmount Glass Works, Inc., were all re-elected to their posts for another term of three years.

Before presenting some highlights of the Glass Container Associations activities of the past year it is interesting to note that the industry last year produced and shipped the astonishing total of roughly seventy million gross of glass containers of all types. The shipment of such an enormous quantity of container ware achieved a goal which had previously been considered fantastically high. Operations for the first four months of 1942 have been further accelerated over the same period of 1941. It has been pointed out, however, that when seasonal increases are normally expected business has been hesitant in practically all lines. Some companies have even reported an actual recession. The feeling in the container industry is that unless present trends and existing uncer-

tainties are corrected particularly with respect to alleviating the restrictions on closure materials the industry faces a considerable curtailment in glass container sales.

The industry continues to function on a minimum of trade promotion. Work is still being carried on, however, with "The Bottle Front" and "The Beer Bottler" as publicity media in the milk and beer fields respectively.

Research on glass packed foods which has been carried on under an Association Fellowship at Massachusetts State College will be continued for another year starting July 1, 1942.

The work on standard testing procedure and glass research under the Preston Laboratory while not directly connected with the industry's war problem will, it is felt, play an important part in the full maintenance of quality under present operating conditions. Careful watch is being kept of the effect of various batch changes necessitated by restrictions on critical or scarce materials.

Due to war conditions the necessary personnel have not been available for the past six months to carry on much fundamental research on cords. However, at the same time considerable experience in the utility and application of the cord promotion technique has been gained. Dr. Ghering has been spending all available time on the practical problems of cordy ware.

An industry survey has been made based on this new technique of quantitatively determining cord. Confidential reports have been furnished to a considerable number of companies. Additional surveys are contemplated and it is expected that this will result in the accumulation by next fall of considerable factual information concerning the trends in glass quality in the industry.

Traffic problems under the direction of J. C. Magness always demand the most careful and painstaking attention. Naturally this phase of the industry's activities are magnified many times by war time demands on our carrier systems.

Restrictive orders of the Office of Defense Transportation currently furnish new problems in traffic affairs and it is assumed their effect will extend to all other departments of the industry. The basic purpose of O.D.T. orders is one of conservation. To conserve the use of freight cars and to prolong the life of trucks. Tires, equipment and parts will not be available for replacement as these essentials wear out. It must be recognized that the O.D.T. concerns itself first with war objectives. In pursuance of its major function the urgent demands of war time transportation sometimes cause orders to be issued which hinder the industry's operations. Modification of these orders may be secured based on reasons acceptable to the Office of Defense Transportation but increasing difficulties in the traffic situation can be depended upon.

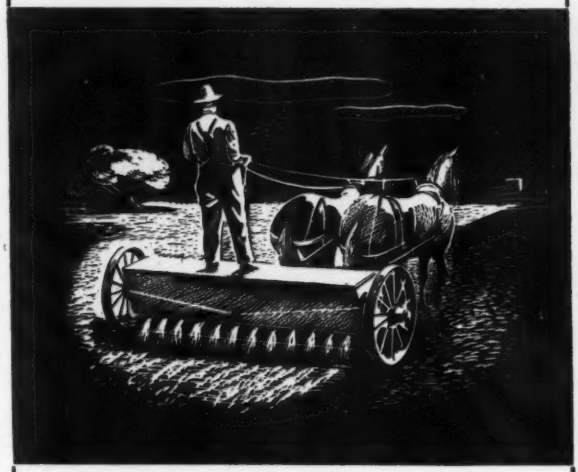
The Standardization and Simplification program, well under way before the spring meeting was called to order, is functioning smoothly and the resulting benefits from this work will be increasingly apparent as difficulties arise in serving the varied industries which use glass as a packaging medium.

In closing this report of the 1942 Spring Meeting of the Glass Container Association it should be mentioned that notwithstanding the many and varied difficult problems which confront the industry today there was no lack

(*Continued on page* 236)

Lime, essential in glass

is also essential in agriculture



At the same time that lime is playing a big part in *the making of glass*, it is also helping farmers to meet the demands of the Department of Agriculture for bigger and better crops . . . corn 8% more: soybeans 54% more: barley 6% more; and two and a half times more peanuts.

Lime is helping by correcting soil acidity and supplying the plant foods calcium and magnesium. Together with fertilizer it is enabling farmers to raise crops that will help to win the war.

For example, according to the National Lime Association, "At the Indiana Experiment Station the yield of soybeans on an acid soil (pH5.2) was increased from 15.7 bushels per acre to 28.2 bushels when soil was limed and fertilized. An increased yield of 80%."

In four essential industries—agriculture, steel, glass, and building—lime and limestone are essential materials. The quarry output of Banner Lime and stone is being used by these essential industries for the all-out drive for victory. National Mortar and Supply Company, Pittsburgh, Pennsylvania.

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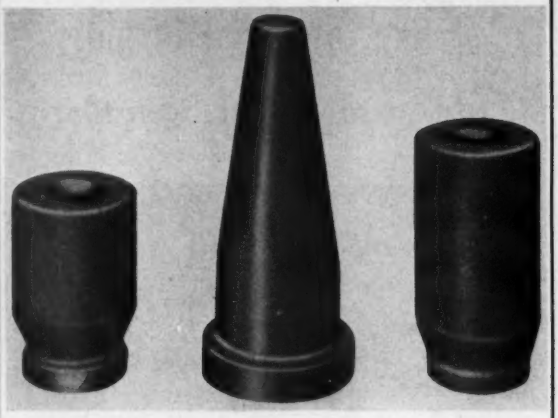

GUNITE bottle moulds will reduce your production costs for GUNITE metal has the right hardness to facilitate easy machining and the right density to assure a metal which will take a brilliant polish. GUNITE has excellent thermo-conductivity, resistance to heat fatigue, freedom from foundry defects and an unusually long life.
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WE ASK NO QUARTER

Publicity is publicity and ought to be appreciated, even when it is both undeserved and anonymous. THE GLASS INDUSTRY hereby acknowledges the following paragraph, which appeared prominently in a recent issue of a highly esteemed glass publication, headed "It Could Only Happen in New York":

"After spending 25 cents cash in the New York office of a glass field monthly for a current issue, we returned with a question we had forgotten. We forgot the question again. When we reopened the door part of the office force was huddled about our quarter testing it for counterfeit leanings. Oh, New York."

Yes, the gentleman did pay a quarter, cash, for a copy of our magazine. We think it was worth it. He also asked for, and got, a receipt for his money. The "question" he returned with was a statement that he wanted the receipt to prove that we had made him pay for the magazine. He seemed to regard this as unethical or, maybe, just plain stingy. All of which leads up to some elementary facts about publishing which may not be generally known, even inside the trade.

First, THE GLASS INDUSTRY is a member of the Audit Bureau of Circulations, an organization which assures our advertisers that our circulation is what we say it is. And a prime requirement of ABC membership is to account for all copies circulated, whether by subscription or single-copy sale. Magazines which are not members of the ABC, of course, do not have to make such a strict accounting. Second, there are, however, certain accepted courtesies between publishers, including exchange of copies without charge. But, although we've heard it said that publishers are a funny-looking crew, we have never learned to identify them by sight alone. If our visitor had said, "I'm from the — —," when he first came in, we would have been able, somehow, to arrange that he get a magazine without charge. He preferred to remain incognito, so we took his two bits—and he gave us space in his paper which is surely worth more than that.

We can't help feeling that we owe our contemporary something for what the courts call "mental anguish." If he will come in again, we'll not only refund his 25 cents, we'll take him to dinner and the kind of show that "could only happen in New York." There is only one requirement: He must open the proceedings with a frank and unashamed confession of his name and connection.

P.S. The quarter was O. K.

USE OF GLASS . . . TOPIC AT G.C.A. MEETING

(*Continued from page* 235)

of that spirit of good-fellowship and conviviality which always abounds when glassmen and affiliated members assemble. The cocktail party and banquet, informal as it was, provided fun and relaxation. Golf attracted the usual number of competitors. There were twenty-eight prizes for the "shooting" with the first four prize winners coming in as follows: low gross, J. A. Kienle, Mathieson Alkali Works, Inc; low net, W. J. Murphy, American Potash & Chemical Corporation; longest drive, 1st tee: E. Terner, Metro Glass Bottle Company; and Kickers Handicap; T. E. Woodman, General Felt Products, Inc.

GLASS INSPECTION
with the *Polaroid*

Spectacle type polariscope

THE polarizing spectacle, mounted in unit with sensitive tint plate of 565 millimicrons, presents an absolutely uniform field of large aperture, strains showing up in sharply defined and correct colors.

Standard size apertures are 6" diameter and 12" diameter; but any special size to meet your requirement can be made. They are all light in weight and a leather case can be furnished where required. The 6" unit is suggested for either plant inspection uses or—as a portable unit for the trouble shooter or the salesman where a large aperture, compact unit of light weight is desirable.

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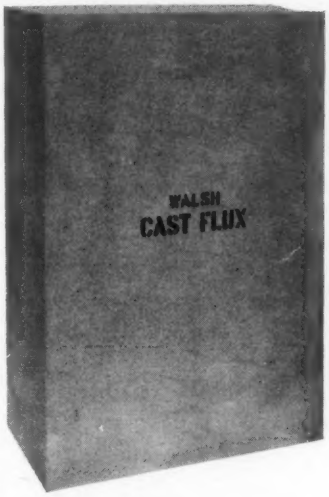

The Vacuum-cast flux block of superior quality.

Walsh Cast-Flux blocks are machine-trued to exact size and shape after burning.

THEY LAST LONGER

The excellent results obtained in numerous tanks melting various types of glass has definitely established the efficiency and economy of Walsh Cast-Flux blocks.

Walsh Cast-Flux has a dense, uniform structure; it is burned at higher temperatures, is thoroughly bonded and possesses a low coefficient of expansion.

Walsh Cast-Flux blocks meet the most rigid requirements for tanks operating at higher temperatures . . . they insure greater tonnage, higher quality glass, freedom from defects, longer life and maximum economy.

WALSH REFRACTORIES CORPORATION

Manufacturers of Refractories for the glass industry for over 50 years

4428 North First Street
St. Louis Missouri

RESISTANCE OF BOTTLES TO ABUSE

(*Continued from page* 221)

Summary

The subject has too many variables for any simple digest, but it may be said that, as regards manufacturing, the things to avoid are chiefly (1) heterogeneity, (2) unintentional ridges, (3) large bottles; as regards design the factors to be watched and avoided are (4) an anvil to back up the hammer, (5) raised lettering or other intentional ridges, if very sharp in contour.

[1]A.S.T.M. Tentative Tests for Glass Containers; A.S.T.M. designation C147-40T; C148-40T; and C149-40T; American Society for Testing Materials, 2605 Broad Street, Philadelphia, Pa.
[2]T. C. Baker; "Water Hammer Breakage in Glass Containers." THE GLASS INDUSTRY, **22**; 430, 469, 521 (Oct., Nov., Dec. 1941).
[3]F. W. Preston, "Strength of Bottles as Affected by the Limitations of the Manufacturing Processes." (To be published by American Ceramic Society.)
[4]L. G. Ghering, "Improving the Strength of Glass Containers Through Design," THE GLASS INDUSTRY, No. 20 (December 1939).
[5]F. W. Preston, "Bottles for Internal Pressure," THE GLASS INDUSTRY, No. 21 (June 1940).
[6]John M. McCormick, "Tests of the Strength of Electric Lamp Bulbs . . ."; Bull. Amer. Cer. Soc. **15**, (8), 268, (1936).
[7]C. E. Gould & W. M. Hampton, "The Thermal Endurance of Glass," *Jr. Soc. Glass Tech.* (London) XIV, 188 (1930).
[8]W. M. Hampton, "The Effect of Shape on the Bursting Strength of Tubes"; Jr. Soc. Glass Tech. (London) **XXV**, 121. (April).
[9]V. C. Swicker, "Ring Section Examination of Glass Containers"; *Bull. Amer. Cer. Soc.* **18**, (4), 143, (1939).
[10]J. C. Turnbull, "Separation of Inhomogeneities in Bottle Glass by Density Differences"; Jr. Amer. Cer. Soc. **24**, 37, (2), (1941). Also J. C. Turnbull & L. G. Ghering, "Cord Analysis," **24**, 264, (8) (1941).
[11]J. E. Ablard, "Analysis of Strains in Glass Produced by Applied Color Labels," unpublished paper given at Urbana Conference on glass problems, No. 14-15, 1941; Abstract, THE GLASS INDUSTRY, **22**, (12), 513, (1941).

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This explains why, even though Solvay is America's largest producer of alkalies, it cannot always supply full alkali requirements of the many Solvay customers who manufacture other than war materials.

Yet, as fast as changeovers can possibly be made, we are *increasing* production of important alkalies and related products to meet war time needs. At the same time, it is possible that Solvay Technical Service may prove helpful in finding a solution to problems arising from material shortages. Inquiries are cordially solicited.

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So again, and in still another way, Bausch & Lomb gives aid to America's all-out for Victory. Its other contributions, more obvious, include gunfire control equipment—rangefinders, binoculars, aerial height finders. Behind the scenes, but of no less importance, are the instruments of industrial research and production — metallographic equipment, spectrographs, toolmakers' microscopes, contour-measuring projectors. Bausch & Lomb eye-wear products—eye examination instruments, spectacle lenses and frames—keep a nation of workers at top visual efficiency.

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